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## IMAGES ARE BEST AVAILABLE COPY.

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FIG. 1

| | | Nd [wt%] | Pr [wt%] | Dy [wt%] | Co [wt%] | Cu [wt%] | Al [wt%] | B [wt%] | M(Zr,Ti) [wt%] | $O_2$ [ppm] | $N_2$ [ppm] | Fe | THICKNESS OF ALLOYS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXAMPLE1 | LOW R ALLOY | 23.6 | 6.0 | 0.3 | — | 0.05 | 0.23 | 1.1 | 0~0.22(Zr) | — | — | bal. | 250~340 μm |
| | HIGH R ALLOY | 40.6 | — | — | 5.0 | 0.05 | 0.23 | — | — | — | — | bal. | 530 μm |
| | COMPOSITION OF SINTERED BODY | 25.0 | 5.3 | 0.3 | 0.5 | 0.05 | 0.23 | 1.0 | 0~0.20(Zr) | 670 | 300 | bal. | — |
| COMPARATIVE EXAMPLE 1 | LOW R ALLOY | 23.6 | 6.0 | 0.3 | — | 0.05 | 0.23 | 1.1 | 0~0.22(Ti) | — | — | bal. | 250~340 μm |
| | HIGH R ALLOY | 40.6 | — | — | 5.0 | 0.05 | 0.23 | — | — | — | — | bal. | 530 μm |
| | COMPOSITION OF SINTERED BODY | 25.0 | 5.3 | 0.3 | 0.5 | 0.05 | 0.23 | 1.0 | 0~0.20(Ti) | 780 | 320 | bal. | — |
| COMPARATIVE EXAMPLE 2 | LOW R ALLOY | 23.6 | 6.0 | 0.3 | — | 0.05 | 0.23 | 1.1 | - | — | — | bal. | 310 μm |
| | HIGH R ALLOY | 40.6 | — | — | 5.0 | 0.05 | 0.23 | 0.5 | 0~2.0(Zr) | — | — | bal. | 470~550 μm |
| | COMPOSITION OF SINTERED BODY | 25.0 | 5.3 | 0.3 | 0.5 | 0.05 | 0.23 | 1.0 | 0~0.20(Zr) | 920 | 350 | bal. | — |
| COMPARATIVE EXAMPLE 3 | LOW R ALLOY | 23.6 | 6.0 | 0.3 | — | 0.05 | 0.23 | 1.1 | 0~0.22(Zr) | — | — | bal. | 470~550 μm |
| | HIGH R ALLOY | 40.6 | — | — | 5.0 | 0.05 | 0.23 | — | — | — | — | bal. | 530 μm |
| | COMPOSITION OF SINTERED BODY | 25.0 | 5.3 | 0.3 | 0.5 | 0.05 | 0.23 | 1.0 | 0~0.20(Zr) | 630 | 290 | bal. | — |



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FIG. 2

| | ADDITIVE ELEMENT M | ADDITIVE AMOUNT OF M [wt%] | PRESENCE OR ABSENCE OF INTRAPHASE PRODUCT | Br [kG] | HcJ [kOe] | Hk/HcJ [%] |
|---|---|---|---|---|---|---|
| REFERENCE EXAMPLE | — | 0 | × | 14.03 | 12.92 | 51.7 |
| EXAMPLE 1 | Zr | 0.02 | ○ | 13.94 | 13.29 | 81.8 |
| | | 0.03 | | 13.97 | 13.39 | 96.5 |
| | | 0.05 | | 13.96 | 13.56 | 97.5 |
| | | 0.10 | | 13.95 | 13.62 | 96.3 |
| | | 0.20 | | 13.86 | 13.75 | 96.3 |
| COMPARATIVE EXAMPLE 1 | Ti | 0.03 | ○ | 13.95 | 13.00 | 85.0 |
| | | 0.05 | | 13.90 | 12.85 | 98.2 |
| | | 0.10 | | 13.81 | 12.85 | 98.2 |
| | | 0.15 | | 13.75 | 13.08 | 97.9 |
| | | 0.20 | | 13.67 | 13.31 | 97.6 |
| COMPARATIVE EXAMPLE 2 | Zr | 0.05 | × | 13.99 | 13.56 | 63.0 |
| | | 0.10 | | 13.90 | 13.43 | 85.2 |
| | | 0.20 | | 13.73 | 13.36 | 96.6 |
| COMPARATIVE EXAMPLE 3 | Zr | 0 | × | 14.05 | 12.34 | 53.5 |
| | | 0.05 | | 13.98 | 12.58 | 73.3 |
| | | 0.10 | | 13.92 | 12.64 | 88.3 |
| | | 0.20 | | 13.78 | 12.67 | 96.6 |

FIG. 3

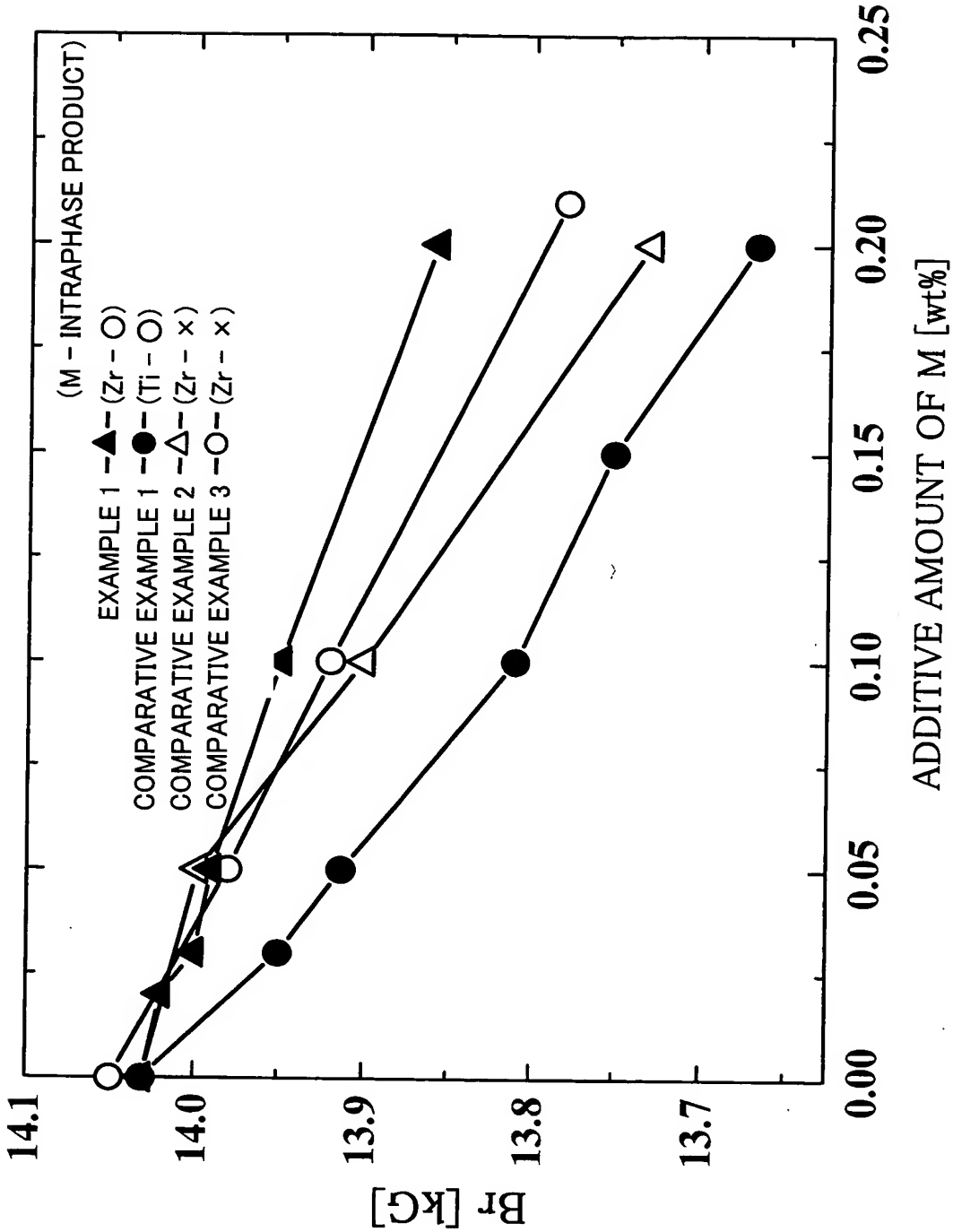

Br [kG]
14.1
14.0
13.9
13.8
13.7
0.00
0.05
0.10
0.15
0.20
0.25
ADDITIVE AMOUNT OF M [wt%]
(M - INTRAPHASE PRODUCT)
EXAMPLE 1 (Zr - O)
COMPARATIVE EXAMPLE 1 (Ti - O)
COMPARATIVE EXAMPLE 2 (Zr - x)
COMPARATIVE EXAMPLE 3 (Zr - x)

FIG. 4

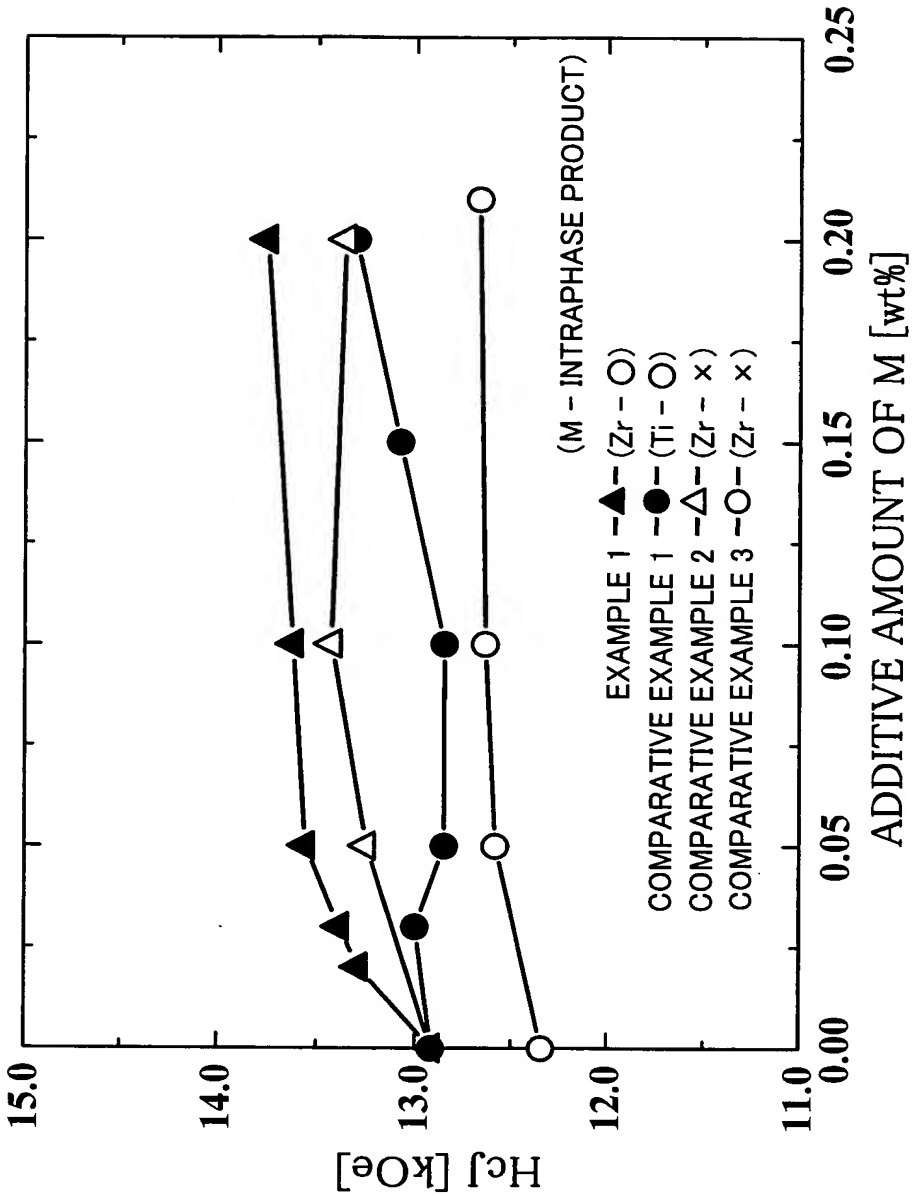

15.0
14.0
13.0
12.0
11.0
HcJ [kOe]
0.00
0.05
0.10
0.15
0.20
0.25
ADDITIVE AMOUNT OF M [wt%]
(M - INTRAPHASE PRODUCT)
EXAMPLE 1 (Zr - O)
COMPARATIVE EXAMPLE 1 (Ti - O)
COMPARATIVE EXAMPLE 2 (Zr - x)
COMPARATIVE EXAMPLE 3 (Zr - x)

FIG. 5

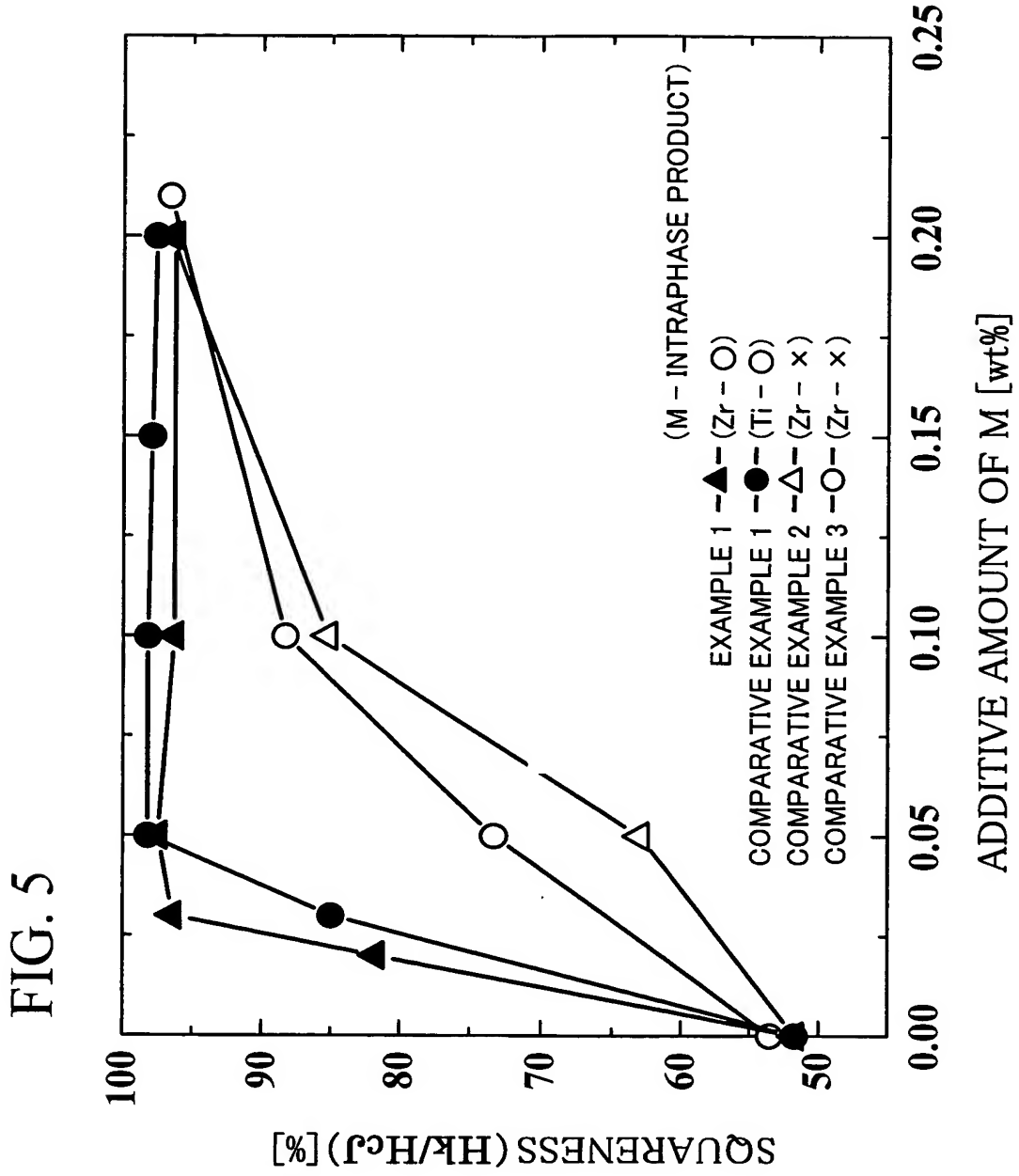

SQUARENESS (HK/HcJ) [%]
100
90
80
70
60
50
0.00
0.05
0.10
0.15
0.20
0.25
ADDITIVE AMOUNT OF M [wt%]
(M - INTRAPHASE PRODUCT)
EXAMPLE 1 (Zr - O)
COMPARATIVE EXAMPLE 1 (Ti - O)
COMPARATIVE EXAMPLE 2 (Zr - x)
COMPARATIVE EXAMPLE 3 (Zr - x)

FIG. 6

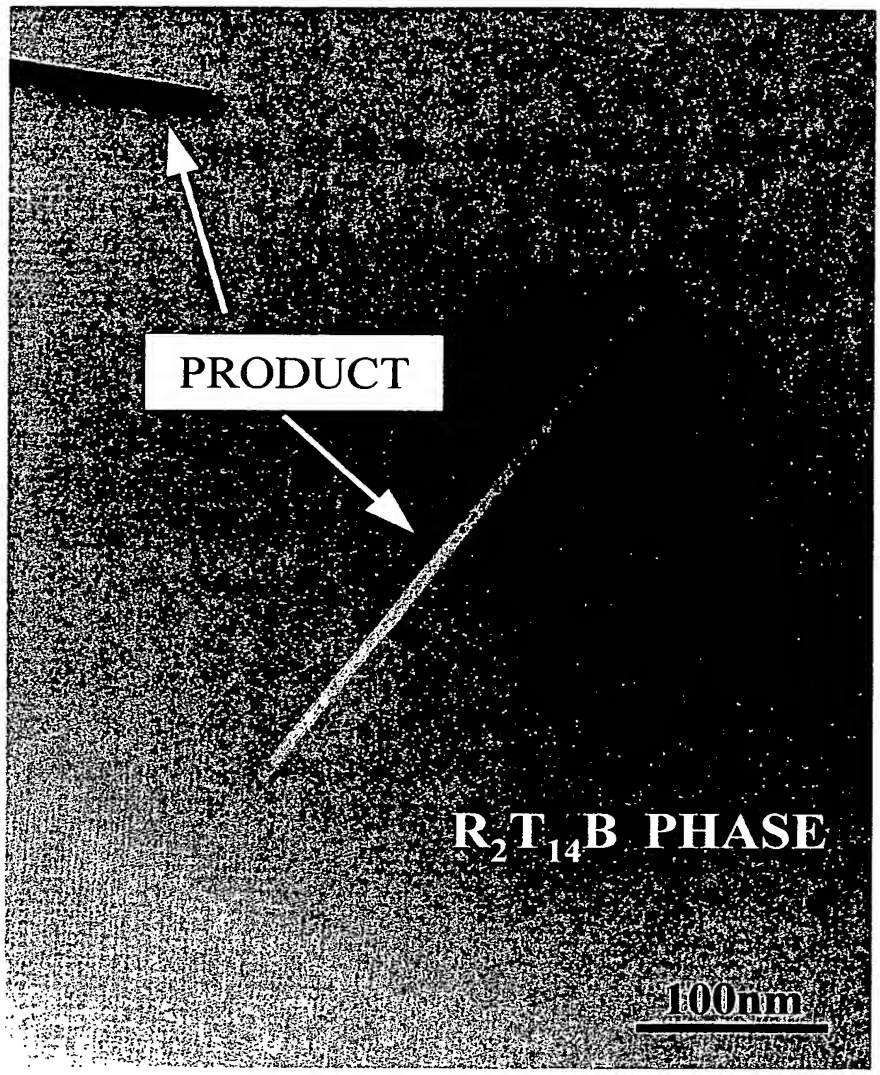


FIG. 7A

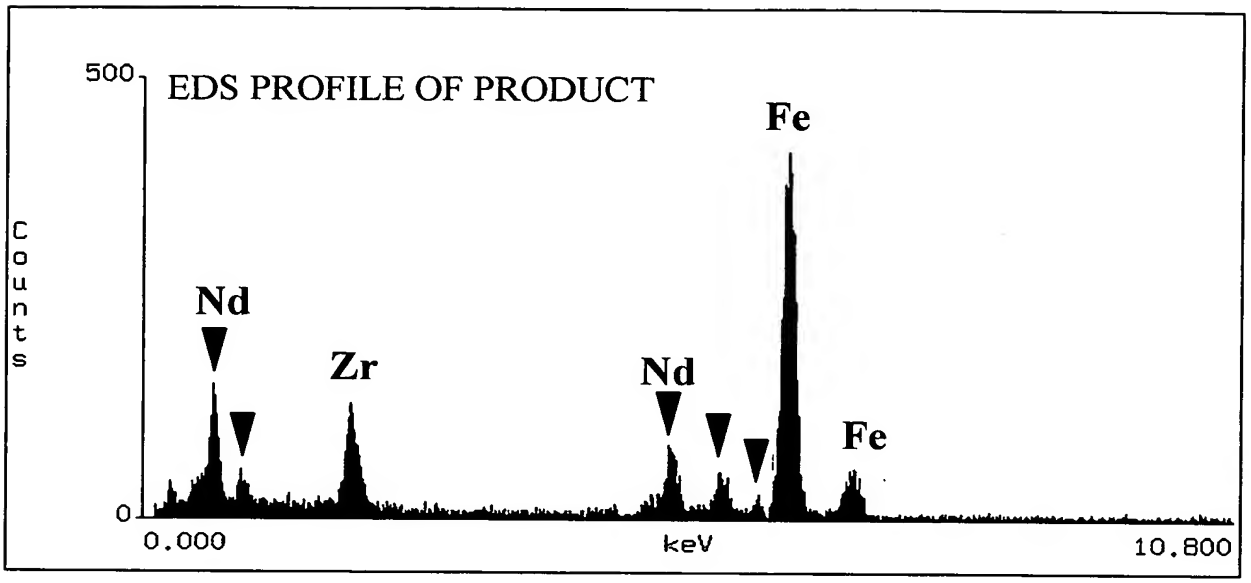

500
EDS PROFILE OF PRODUCT
Fe
Counts
Nd
Zr
Nd
Fe
0
0.000
keV
10.800

FIG. 7B

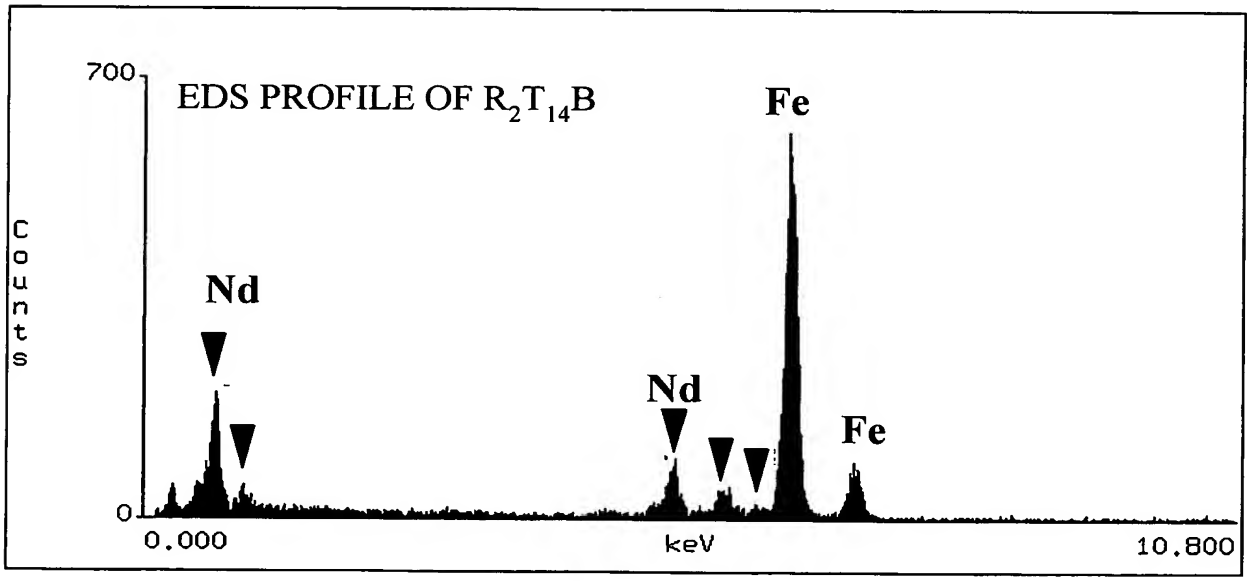
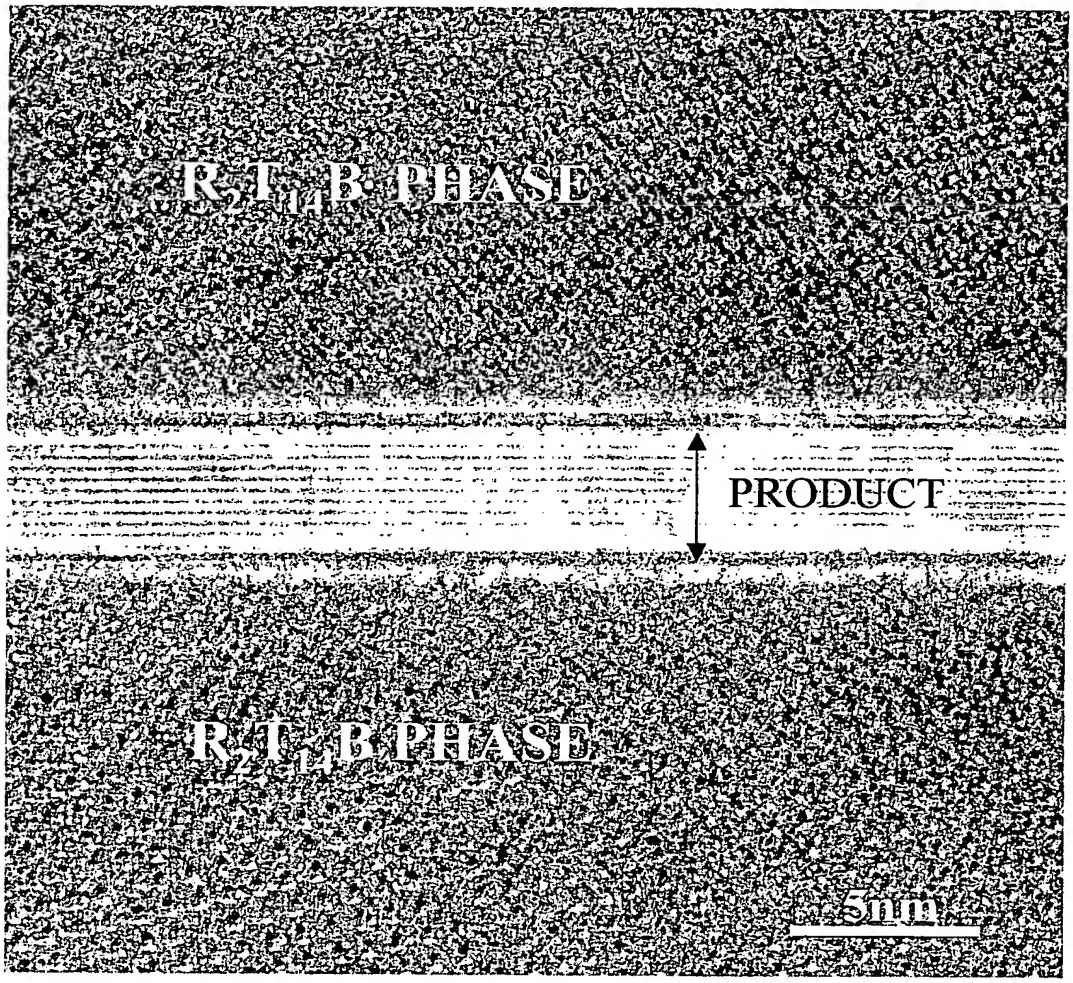

700
EDS PROFILE OF $R_2T_{14}B$
Fe
Counts
Nd
Nd
Fe
0
0.000
keV
10.800

FIG. 8



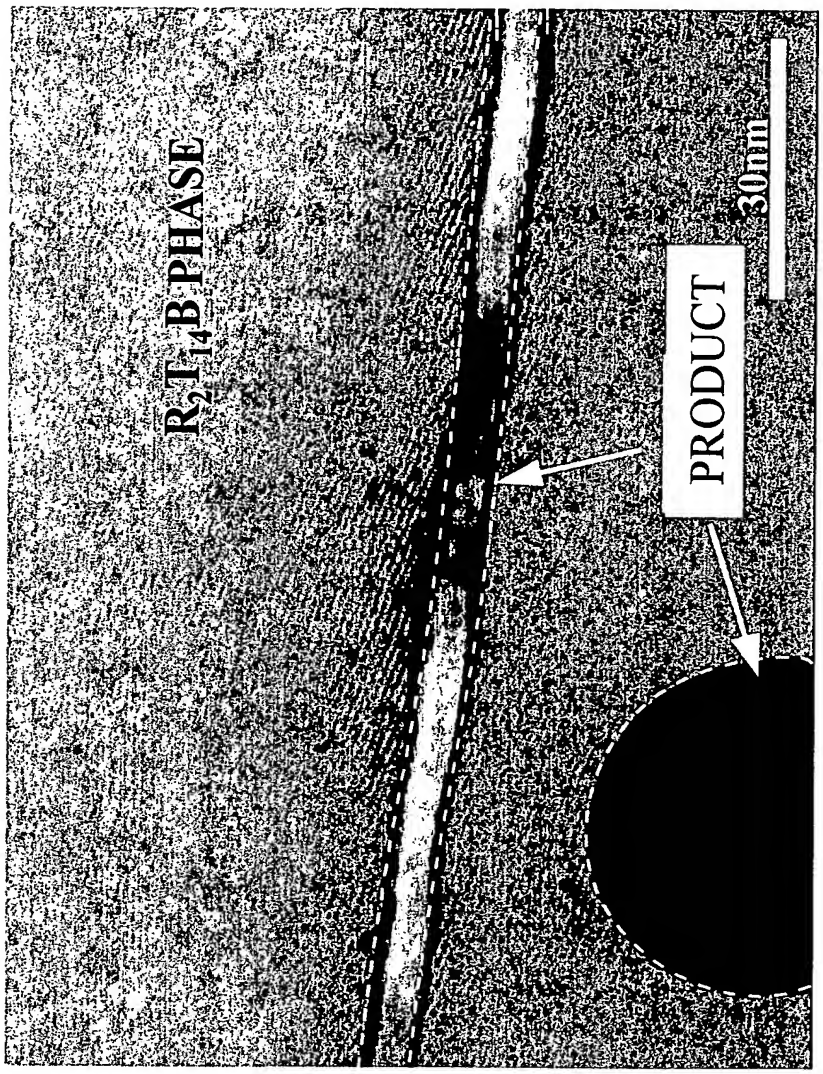



FIG. 9

FIG. 10

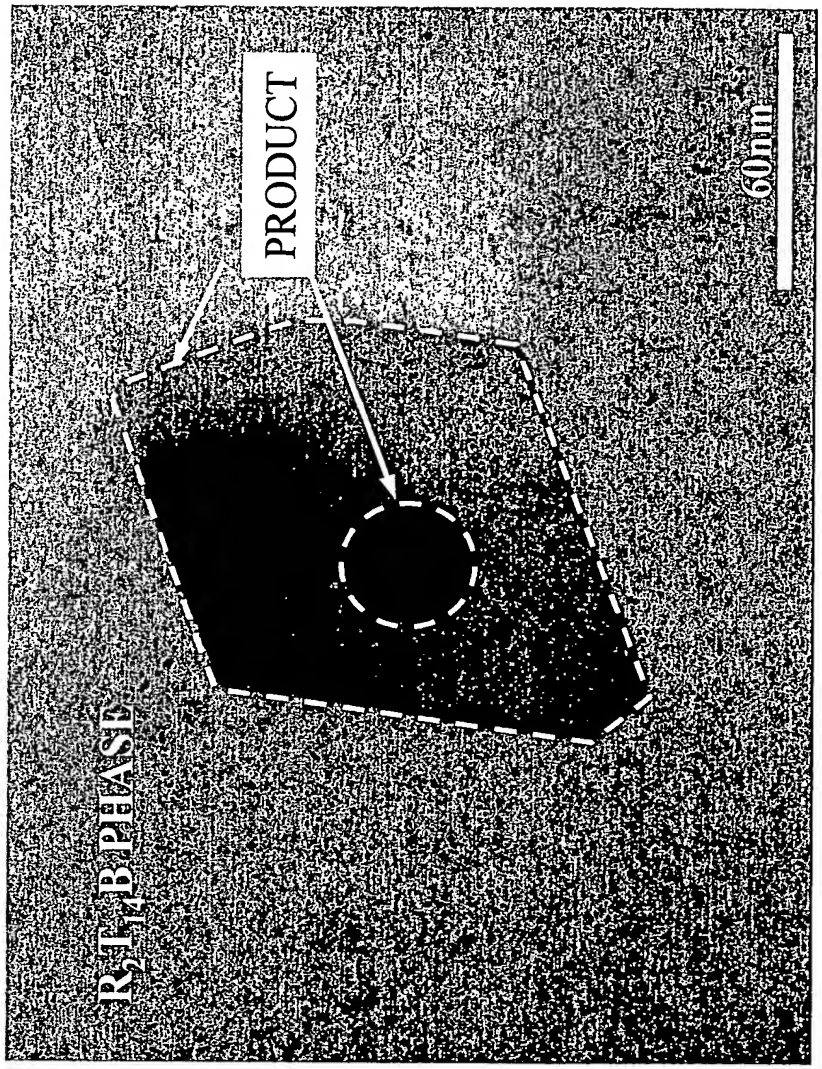


FIG. 11A

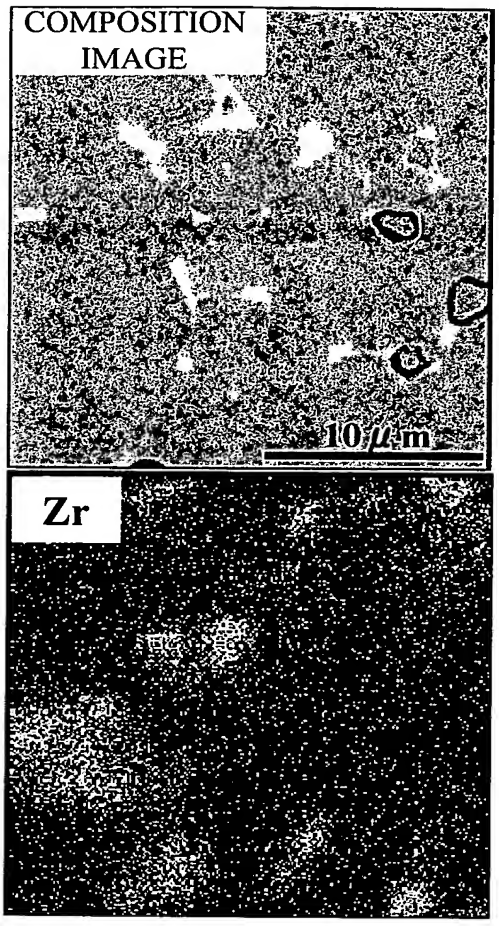



FIG. 11B

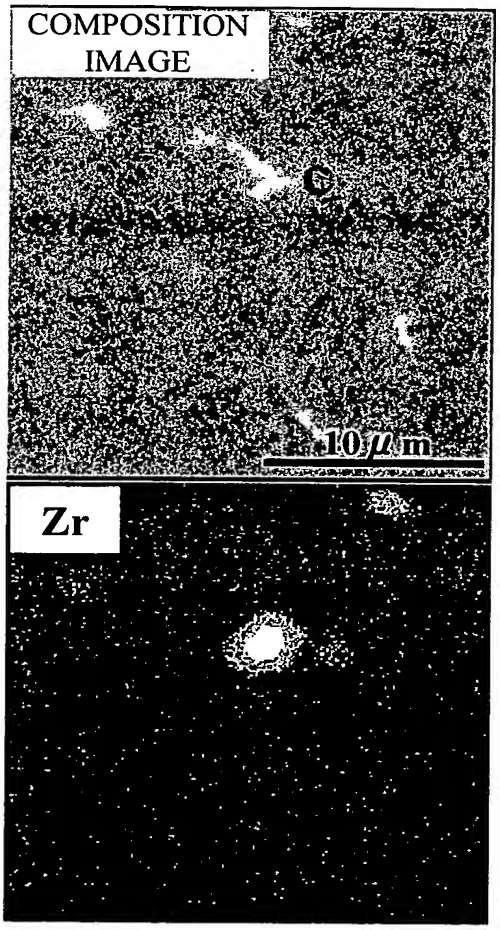


FIG. 12

| | ADDITIVE ELEMENT M | ADDING METHOD OF M | ADDITIVE AMOUNT OF M [wt%] | PRESENCE OR ABSENCE OF INTRAPHASE PRODUCT | SINTERING TEMPERATURE [°C] | Br [kG] | HcJ [kOe] | Hk/HcJ [%] |
|---|---|---|---|---|---|---|---|---|
| REFERENCE EXAMPLE | — | — | 0 | × | 1010 | 13.85 | 11.87 | 84.2 |
| | | | | | 1030 | 13.91 | 12.22 | 85.6 |
| | | | | | 1050 | 13.93 | 13.25 | 88.7 |
| | | | | | 1070 | 14.03 | 12.92 | 51.7 |
| | | | | | 1090 | 14.01 | 12.13 | 39.1 |
| EXAMPLE 2 | Zr | LOW R ALLOYS | 0.1 | ○ | 1010 | 13.81 | 12.56 | 86.3 |
| | | | | | 1030 | 13.92 | 13.26 | 96.1 |
| | | | | | 1050 | 13.93 | 13.52 | 97.0 |
| | | | | | 1070 | 13.95 | 13.62 | 96.3 |
| | | | | | 1090 | 13.90 | 13.42 | 96.0 |
| COMPARATIVE EXAMPLE 4 | Ti | LOW R ALLOYS | 0.1 | ○ | 1010 | 13.74 | 12.13 | 88.4 |
| | | | | | 1030 | 13.74 | 13.05 | 95.3 |
| | | | | | 1050 | 13.75 | 13.18 | 96.2 |
| | | | | | 1070 | 13.76 | 13.08 | 97.9 |
| | | | | | 1090 | 13.71 | 12.68 | 91.3 |
| COMPARATIVE EXAMPLE 5 | Zr | HIGH R ALLOYS | 0.1 | × | 1010 | 13.84 | 12.24 | 86.3 |
| | | | | | 1030 | 13.85 | 12.34 | 88.7 |
| | | | | | 1050 | 13.87 | 13.20 | 91.5 |
| | | | | | 1070 | 13.90 | 13.18 | 90.1 |
| | | | | | 1090 | 13.75 | 12.56 | 75.3 |

FIG. 13

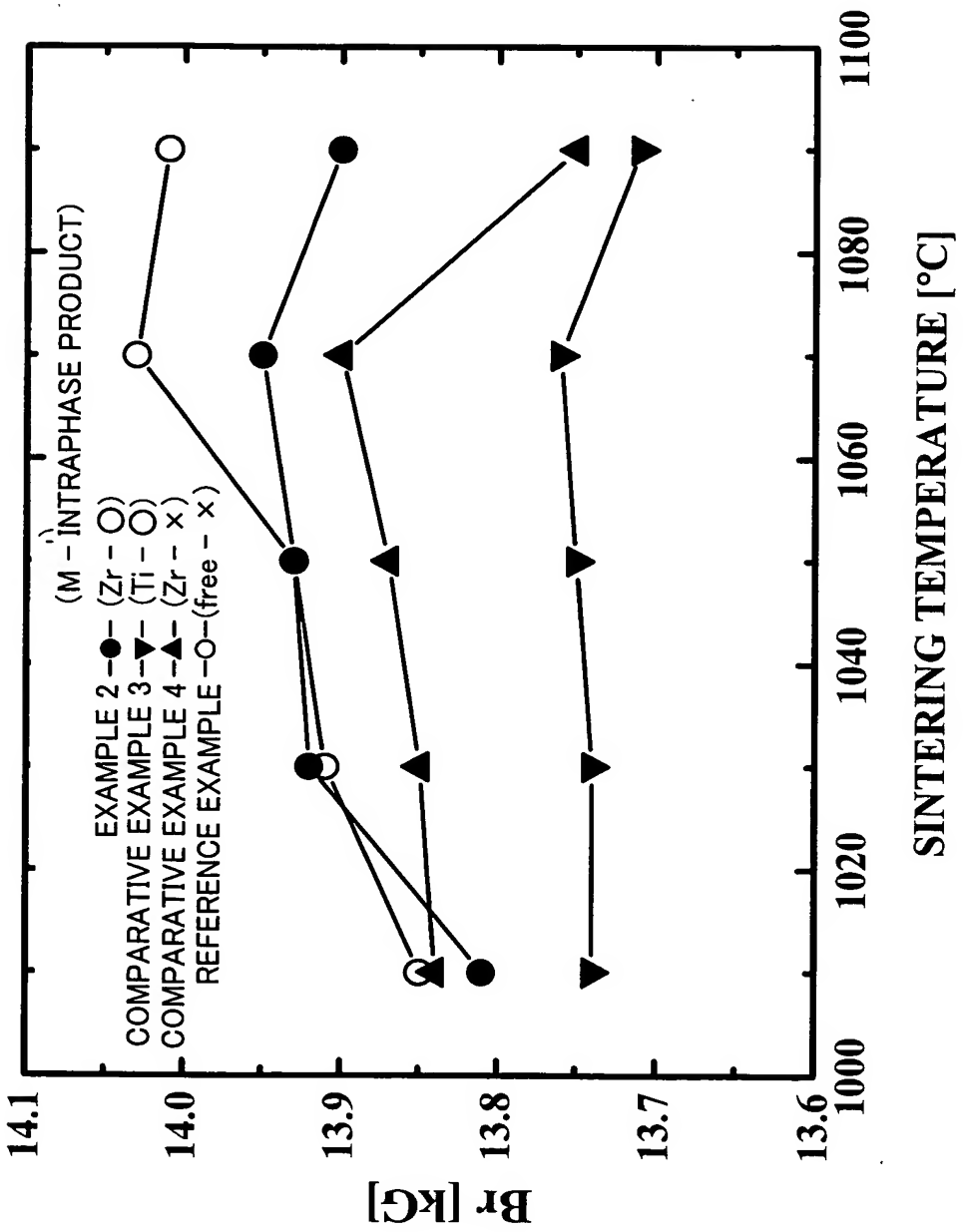

Br [kG]
14.1
14.0
13.9
13.8
13.7
13.6
1000
1020
1040
1060
1080
1100
SINTERING TEMPERATURE [°C]
(M - INTRAPHASE PRODUCT)
EXAMPLE 2 -●- (Zr - O)
COMPARATIVE EXAMPLE 3 -▼- (Ti - O)
COMPARATIVE EXAMPLE 4 -▲- (Zr - ×)
REFERENCE EXAMPLE -O-(free - ×)

FIG. 14

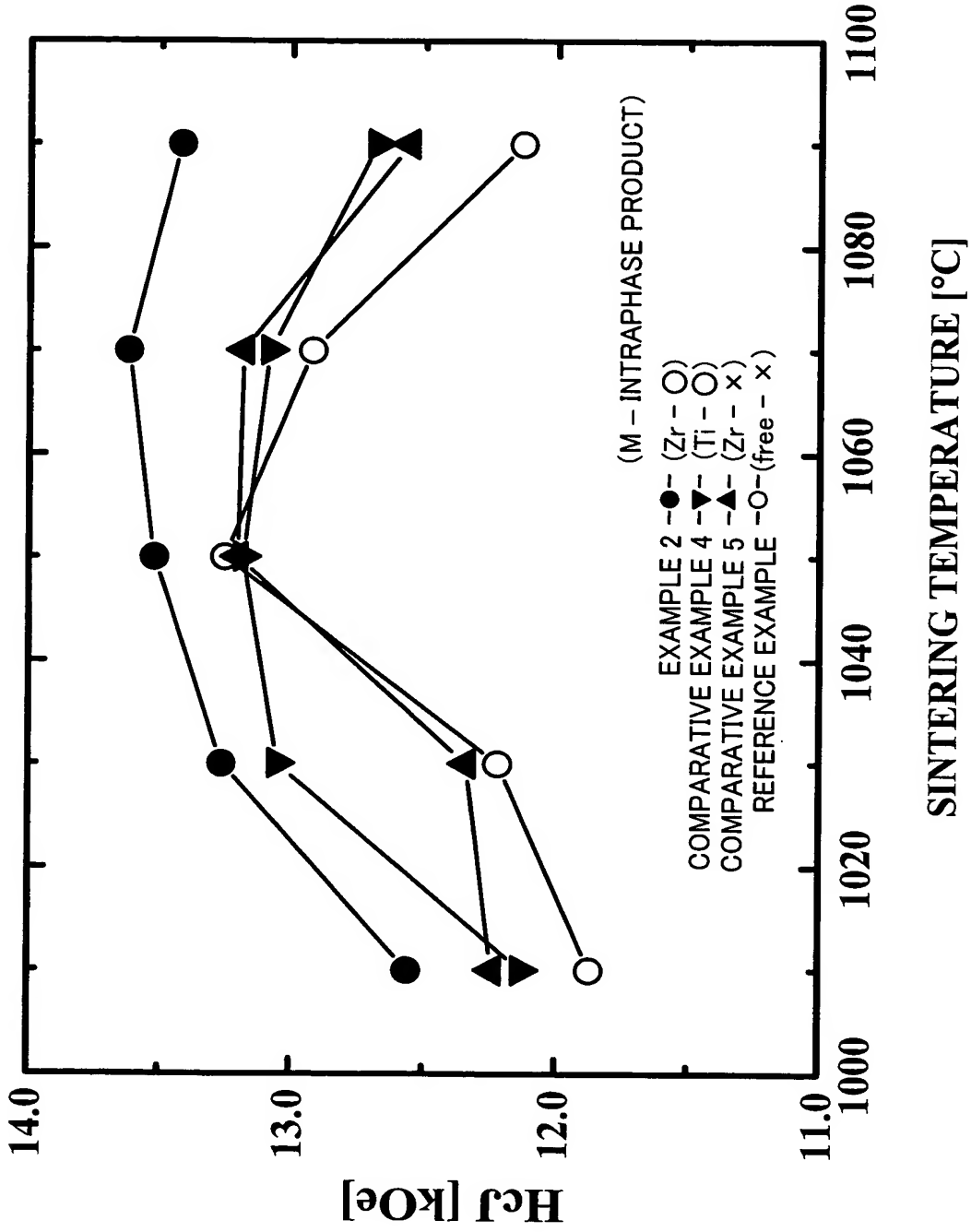

14.0
13.0
12.0
11.0
1000
1020
1040
1060
1080
1100
HcJ [kOe]
SINTERING TEMPERATURE [°C]
(M – INTRAPHASE PRODUCT)
EXAMPLE 2 –●– (Zr – ○)
COMPARATIVE EXAMPLE 4 –▼– (Ti – ○)
COMPARATIVE EXAMPLE 5 –◀– (Zr – ×)
REFERENCE EXAMPLE –○–(free – ×)

FIG. 15

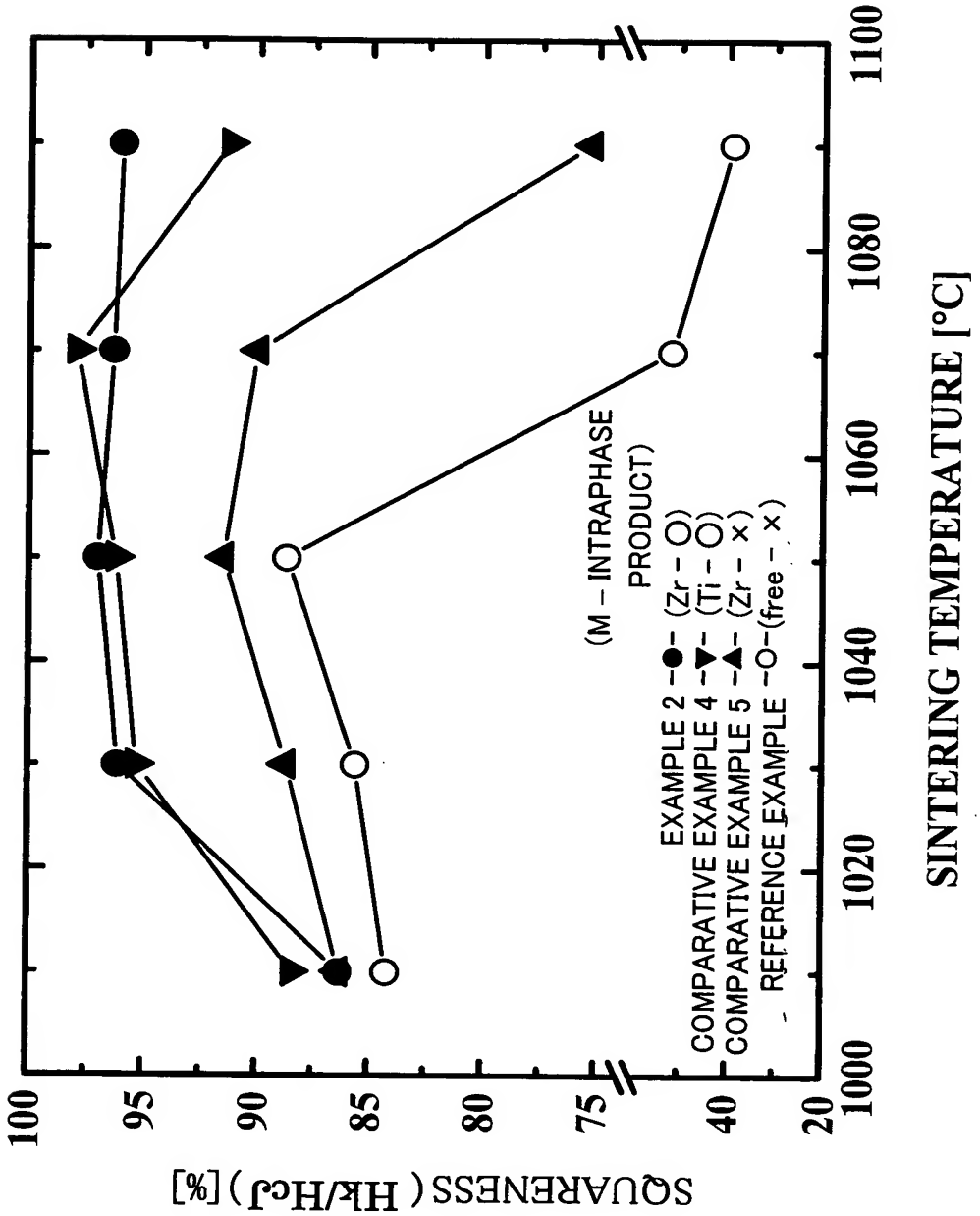

SQUARENESS ( HK/HcJ ) [%]
100
95
90
85
80
75
40
20
1000
1020
1040
1060
1080
1100
SINTERING TEMPERATURE [°C]
(M – INTRAPHASE PRODUCT)
EXAMPLE 2 –●– (Zr – O)
COMPARATIVE EXAMPLE 4 –▼– (Ti – O)
COMPARATIVE EXAMPLE 5 –◀– (Zr – x)
REFERENCE EXAMPLE –O–(free – x)

FIG. 16

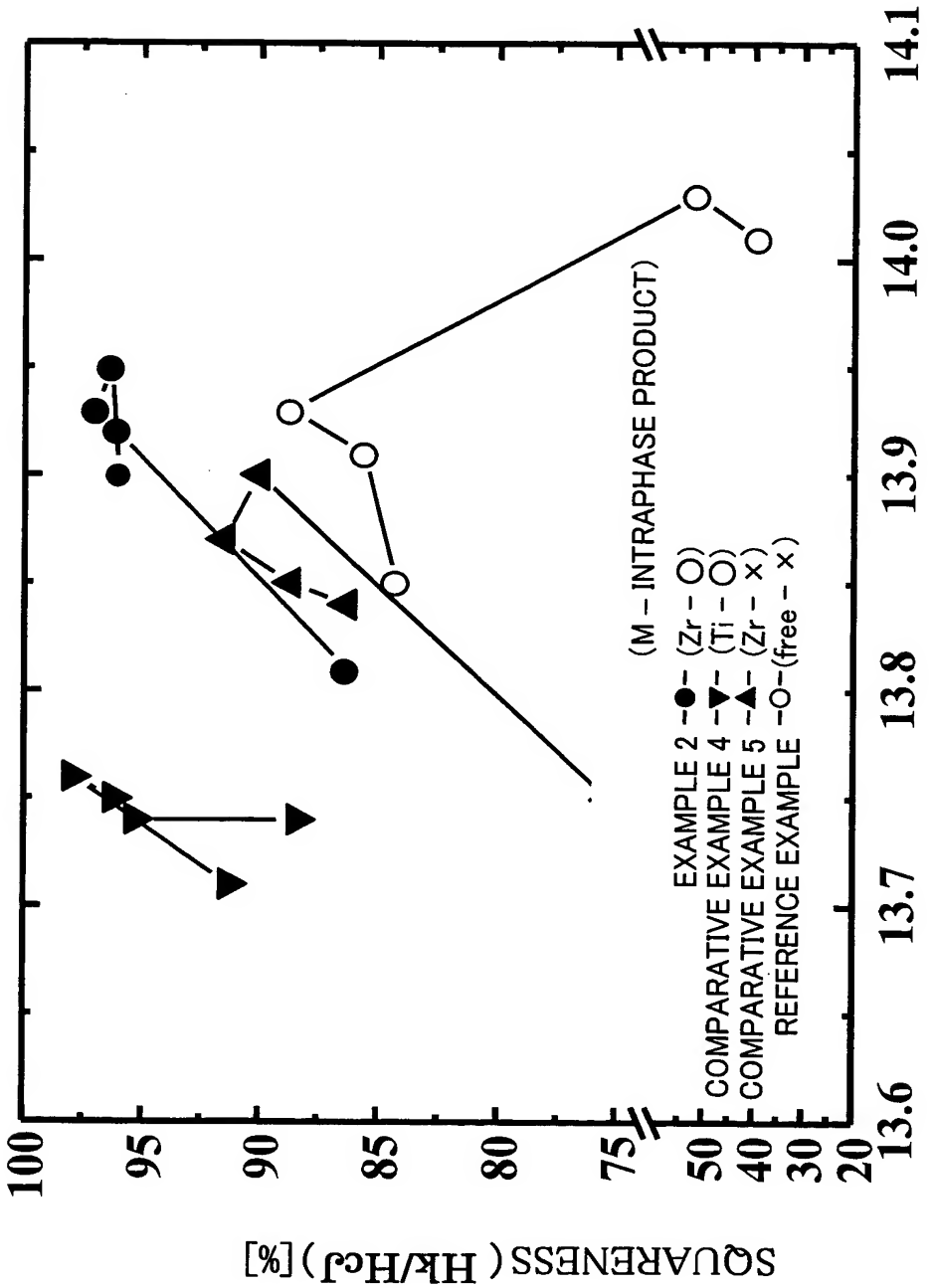

SQUARENESS ( HK/HcJ ) [%]
100
95
90
85
80
75
50
40
30
20
13.6
13.7
13.8
13.9
14.0
14.1
Br [kG]
(M – INTRAPHASE PRODUCT)
EXAMPLE 2 –●– (Zr – O)
COMPARATIVE EXAMPLE 4 –▼– (Ti – O)
COMPARATIVE EXAMPLE 5 –▲– (Zr – ×)
REFERENCE EXAMPLE –O–(free – ×)

FIG. 17

| | | Nd [wt%] | Pr [wt%] | Dy [wt%] | Co [wt%] | Cu [wt%] | Al [wt%] | B [wt%] | Zr [wt%] | $O_2$ [ppm] | $N_2$ [ppm] | Fe | ROLL PERIPHERAL VELOCITY [m/s] | THICKNESS OF ALLOYS [$\mu$m] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE A | LOW R ALLOY | 23.6 | 6.0 | 0.3 | — | 0.05 | 0.23 | 1.1 | 0.09 | — | — | bal. | 1.0 | 370 |
| | HIGH R ALLOY | 40.6 | — | — | 5.0 | 0.05 | 0.23 | — | — | — | — | bal. | 0.6 | 520 |
| | COMPOSITION OF SINTERED BODY | 25.0 | 5.3 | 0.3 | 0.5 | 0.05 | 0.23 | 1.0 | 0.08 | 980 | 380 | bal. | — | — |
| SAMPLE B | LOW R ALLOY | 23.0 | 5.7 | 0.4 | — | 0.05 | 0.18 | 1.1 | 0.12 | — | — | bal. | 1.8 | 240 |
| | HIGH R ALLOY | 40.6 | — | — | 5.0 | 0.05 | 0.23 | — | — | — | — | bal. | 0.6 | 520 |
| | COMPOSITION OF SINTERED BODY | 24.8 | 5.1 | 0.4 | 0.5 | 0.05 | 0.19 | 1.0 | 0.11 | 720 | 440 | bal. | — | — |
| SAMPLE C | LOW R ALLOY | 22.5 | 6.2 | 0.4 | — | 0.05 | 0.23 | 1.1 | 0.20 | — | — | bal. | 1.6 | 270 |
| | HIGH R ALLOY | 40.6 | — | — | 5.0 | 0.05 | 0.23 | — | — | — | — | bal. | 0.6 | 520 |
| | COMPOSITION OF SINTERED BODY | 24.3 | 5.6 | 0.4 | 0.5 | 0.05 | 0.23 | 1.0 | 0.18 | 870 | 420 | bal. | — | — |
| SAMPLE D | LOW R ALLOY | 22.7 | 5.9 | 1.3 | — | 0.05 | 0.23 | 1.1 | 0.20 | — | — | bal. | 1.5 | 320 |
| | HIGH R ALLOY | 30.3 | — | 10.0 | 5.0 | 0.05 | 0.15 | — | — | — | — | bal. | 0.6 | 550 |
| | COMPOSITION OF SINTERED BODY | 23.5 | 5.3 | 2.2 | 0.5 | 0.05 | 0.22 | 1.0 | 0.18 | 680 | 390 | bal. | — | — |

FIG. 18

| | SINTERING TEMPERATURE [°C] | Br [kG] | HcJ [kOe] | Hk/HcJ [%] |
|---|---|---|---|---|
| SAMPLE A | 1010 | 14.05 | 11.13 | 88.6 |
| | 1030 | 14.06 | 14.61 | 95.0 |
| | 1050 | 14.14 | 14.61 | 97.0 |
| | 1070 | 14.14 | 13.45 | 95.2 |
| | 1090 | 14.22 | 4.26 | 44.0 |
| SAMPLE B | 1010 | 14.03 | 11.85 | 88.0 |
| | 1030 | 14.10 | 14.67 | 95.6 |
| | 1050 | 14.13 | 14.71 | 96.4 |
| | 1070 | 14.15 | 14.35 | 97.5 |
| | 1090 | 14.08 | 13.52 | 96.0 |
| SAMPLE C | 1010 | 13.98 | 12.81 | 87.3 |
| | 1030 | 14.07 | 14.67 | 95.3 |
| | 1050 | 14.08 | 14.72 | 96.1 |
| | 1070 | 14.08 | 14.70 | 98.2 |
| | 1090 | 14.08 | 14.61 | 97.9 |
| SAMPLE D | 1010 | 13.90 | 14.31 | 95.6 |
| | 1030 | 13.90 | 16.07 | 97.8 |
| | 1050 | 13.90 | 16.18 | 97.9 |
| | 1070 | 13.91 | 16.22 | 97.8 |
| | 1090 | 13.92 | 15.83 | 72.1 |

FIG. 19

| | | Nd [wt%] | Pr [wt%] | Dy [wt%] | Co [wt%] | Cu [wt%] | Al [wt%] | B [wt%] | Zr [wt%] | $O_2$ [ppm] | $N_2$ [ppm] | Fe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE E | LOW R ALLOY | 27.9 | - | 0.1 | — | 0.03 | 0.05 | 1.1 | 0.08 | — | — | bal. |
| | HIGH R ALLOY | 35.1 | - | - | 2.0 | 0.03 | 0.05 | - | — | — | — | bal. |
| | COMPOSITION OF SINTERED BODY | 28.3 | - | 0.1 | 0.2 | 0.03 | 0.05 | 1.0 | 0.07 | 720 | 360 | bal. |
| SAMPLE F | LOW R ALLOY | 23.7 | 6.0 | 0.2 | — | 0.30 | 0.25 | 1.6 | 0.30 | — | — | bal. |
| | HIGH R ALLOY | 40.6 | — | - | 20.0 | 0.30 | 0.25 | — | — | — | — | bal. |
| | COMPOSITION OF SINTERED BODY | 26.9 | 4.8 | 0.2 | 4.0 | 0.30 | 0.25 | 1.3 | 0.24 | 980 | 450 | bal. |

FIG. 20

| | Br [kG] | HcJ [kOe] | Hk/HcJ [%] |
|---|---|---|---|
| SAMPLE E | 14.62 | 13.10 | 98.0 |
| SAMPLE F | 13.88 | 15.30 | 96.0 |
| SAMPLE A | 14.14 | 13.45 | 95.2 |
| SAMPLE B | 14.15 | 14.35 | 97.5 |
| SAMPLE C | 14.08 | 14.70 | 98.2 |
| SAMPLE D | 13.91 | 16.22 | 97.8 |